4. ENVIRONMENTAL MONITORING

4.1 SUMMARY

Environmental monitoring at PORTS includes air, water, soil, sediment, and biota (animals, vegetation, and crops) and includes measurement of both radiological and chemical parameters. Environmental monitoring programs are required by state and federal regulations, permit requirements, and DOE Orders, but also are developed to reduce public concerns about plant operations. In 1999, environmental monitoring information was collected by both DOE and USEC. Unlike other chapters of this report that focus on DOE activities at PORTS, this chapter includes monitoring information collected by USEC. Results of environmental monitoring in 1999 indicate that PORTS operations did not have a significant environmental impact inside or outside the reservation boundaries.

4.2 INTRODUCTION

Environmental monitoring programs at PORTS are designed to detect the effects (if any) of PORTS operations on human health and the environment. Multiple samples are collected throughout the year and are analyzed for radionuclides and chemicals that could be present from PORTS activities. The results of these monitoring programs are used to gauge the environmental impacts of PORTS operations and to set priorities for environmental improvements.

Environmental regulations, permit requirements, DOE Orders, and public concerns are all considered in developing environmental monitoring programs. State and federal regulations drive some of the monitoring conducted at DOE/PORTS such as limitations on discharges to air and water. DOE Orders 5400.1, *General Environmental Protection Program*, and 5400.5, *Radiation Protection of the Public and the Environment*, also address environmental monitoring requirements.

Environmental monitoring data is collected by both DOE and USEC. Because USEC data is important in developing a complete picture of environmental monitoring at PORTS, it is included in this report. USEC information is provided for informational purposes only; DOE cannot certify the accuracy of USEC data.

The data from the following environmental monitoring programs are included in this chapter:

- Airborne discharges,
- Ambient air,
- Discharges to surface water,
- Surface water,
- Sediment,
- Soil,
- Vegetation, and
- Biota.

DOE also conducts an extensive groundwater monitoring program at PORTS. Chap. 6 provides information for the groundwater monitoring program, associated surface water monitoring, and residential water supply monitoring.

4.3 AIR

Air monitoring at PORTS includes monitoring of both radiological and chemical discharges from permitted air emission sources. In 1999, USEC also performed ambient air monitoring for radionuclides and fluorides to assess the release of these constituents from PORTS.

4.3.1 Airborne Discharges

4.3.1.1 Radiological airborne discharges

Airborne discharges of radionuclides from PORTS are regulated under the Clean Air Act National Emission Standards for Hazardous Air Pollutants. Releases of radionuclides are used to calculate a dose to members of the public. Chap. 5 discusses the results of this dose calculation.

Because USEC operates the uranium enrichment process at PORTS, USEC is responsible for most of the sources that emit radionuclides. In 1999, USEC reported emissions of 0.9 curie (a measure of radioactivity) from its radionuclide emission sources.

DOE/PORTS is responsible for two emission sources: the X-326 L-cage Glove Box and the X-744G Glove Box. These glove boxes are used to repackage wastes or other materials that contain radionuclides. Emissions from these sources are based on waste analysis data. Radiological emissions from these two DOE sources were 0.000064 curie in 1999.

4.3.1.2 Nonradiological airborne discharges

DOE/PORTS operates numerous small sources of conventional air pollutants such as nitrogen oxides, sulfur dioxide, and particulate matter. These emissions are estimated every two years for the Ohio EPA's biennial emission fee statement.

Emissions of nonradiological air pollutants at DOE/PORTS are estimated using various U.S. EPA-approved procedures. In calculating air emissions, DOE assumes that each source emits the maximum allowable amount of each pollutant as provided in the permit or registration for the source. Under this worst-case scenario, DOE/PORTS estimated emissions of sulfur dioxide, nitrogen oxides, organic compounds, and particulate matter in 1999 to be 13 tons per year. Most of these worst-case emissions resulted from particulate (dust) emissions from the X-734 Landfill Area closure. Worst-case air emissions excluding this source are no more than 1.5 tons per year.

Another potential air pollutant present at DOE/PORTS is asbestos released by renovation or demolition of plant facilities. Asbestos emissions are controlled by a system of work practices. The amount of asbestos removed and disposed is reported to the Ohio EPA. No asbestos was removed or disposed by DOE in 1999.

Nonradiological airborne discharges from USEC sources are not included in this report.

4.3.2 Ambient Air Monitoring

In 1999, USEC collected data from a monitoring network of 15 air samplers. Data was collected both on site at PORTS (Fig. 4.1) and in the area surrounding PORTS (Fig. 4.2). This monitoring network is intended to assess whether air emissions from PORTS affect air quality in the surrounding area. The air sampling stations measure gross alpha radiation, gross beta radiation, and fluorides.

Fig. 4.1. On-site monitoring locations for the USEC ambient air and gamma radiation monitoring programs.

Fig. 4.2. Off-site monitoring locations for the USEC ambient air and gamma radiation monitoring programs.

A background ambient air monitoring station is located approximately 13 miles southwest of the plant. The analytical results from air sampling stations closer to the plant are compared to these background measurements.

The average concentration of gross alpha, gross beta, and gaseous fluorides at sampling stations around PORTS appears to be similar to the background sampling station (A37), with the possible exception of sampling station A12.

Direct radiation, or gamma radiation, is also measured by USEC and DOE at monitoring stations in and around PORTS (see Figs. 4.1 and 4.2). A discussion of the measurements made by DOE and the resulting potential dose to the public is discussed in Chap. 5. Direct radiation measurements collected by USEC indicate that the level of gamma radiation in and around PORTS is similar to background, with the exception of the DOE depleted uranium cylinder storage yards. DOE measurements confirm that cylinders in the storage yards emit higher than background levels of gamma radiation. Public access to radiation from these cylinder yards is controlled as described in Chap. 5.

4.4 WATER

Surface water and groundwater are monitored at PORTS. Groundwater monitoring is discussed in Chap. 6. Surface water monitoring consists of sampling water discharges associated with both DOE and USEC NPDES-permitted outfalls and sampling of local rivers and creeks including the Scioto River, Big Run Creek, Big Beaver Creek, and Little Beaver Creek. DOE also collects surface water samples as part of the groundwater monitoring program at PORTS. These results are also discussed in Chap. 6.

4.4.1 Water Discharges (NPDES Outfalls)

DOE/PORTS has six discharge points, or outfalls, through which water is discharged from the site (see Fig. 4.3). Three outfalls discharge directly to surface water, and three discharge to the USEC X-6619 Sewage Treatment Plant before leaving the site through USEC Outfall 003 to the Scioto River. A brief description of each DOE outfall at PORTS follows.

DOE NPDES Outfall 012 (X-2230M Holding Pond) – The X-2230M Holding Pond accumulates precipitation runoff, non-contact cooling water, and steam condensate from the southern portion of the PORTS reservation. The pond provides an area where solids can settle, chlorine can dissipate, and oil can be separated from the water prior to its release to an unnamed stream that flows to the Scioto River.

DOE NPDES Outfall 013 (X-2230N Holding Pond) – The X-2230N Holding Pond accumulates precipitation runoff, non-contact cooling water, and steam condensate from the southwestern portion of the PORTS reservation. The pond provides an area where solids can settle, chlorine can dissipate, and oil can be separated from the water prior to its release to the West Ditch, which flows to the Scioto River.

DOE NPDES Outfall 015 (X-624 Groundwater Treatment Facility) – This facility removes volatile organic compounds from contaminated groundwater originating from the X-701B plume interceptor trenches. These groundwater interceptor trenches were constructed to control the migration of volatile organic compound-contaminated groundwater toward Little Beaver Creek. Treated water is released to an unnamed stream that flows to Little Beaver Creek.

DOE NPDES Outfall 608 (X-622 Groundwater Treatment Facility) – This facility removes volatile organic compounds from contaminated groundwater originating from site remediation activities in the

Fig. 4.3. PORTS NPDES outfalls and DOE groundwater treatment facilities.

southern portion of the site. Treated water is discharged to the sanitary sewer and then through USEC Outfall 003.

DOE NPDES Outfall 610 (X-623 Groundwater Treatment Facility) – This facility removes volatile organic compounds from contaminated groundwater originating from site remediation activities and from miscellaneous well development and purge waters. Treated water is discharged to the sanitary sewer and then through USEC Outfall 003.

DOE NPDES Outfall 611 (X-622T Groundwater Treatment Facility) – This facility removes volatile organic compounds from groundwater collecting in sumps located in the basements of the X-705 and the X-700 buildings. Treated water is discharged to the sanitary sewer and then through USEC Outfall 003.

USEC is responsible for 11 NPDES outfalls at PORTS (see Fig. 4.3). A brief description of each USEC NPDES outfall follows.

USEC NPDES Outfall 001 (X-230J7 East Holding Pond) – The X-230J7 East Holding Pond receives non-contact cooling water, steam condensate, foundation drainage, and storm runoff. The pond provides an area where materials suspended in the influent can settle, chlorine can dissipate, and oil can be diverted and contained. Water from this holding pond is discharged to an unnamed stream that flows to Little Beaver Creek.

USEC NPDES Outfall 002 (X-230K South Holding Pond) – The X-230K South Holding Pond receives non-contact cooling water, steam condensate, foundation drainage, treated coal pile runoff, and storm runoff. The pond provides an area where materials suspended in the influent can settle, chlorine can dissipate, oil can be contained, and pH can be adjusted. Water from this holding pond is discharged to Big Run Creek.

USEC NPDES Outfall 003 (X-6619 Sewage Treatment Plant) – The X-6619 treats PORTS sewage as well as water discharged from groundwater treatment facilities, the X-700 Biodenitrification Facility, the X-705 Decontamination Microfiltration System, and miscellaneous waste streams. The X-6619 Sewage Treatment Plant uses screening, aeration, clarification, and filtering followed by chlorination to treat wastewater prior to release to the Scioto River.

USEC NPDES Outfall 004 [X-616 Liquid Effluent Control Facility (inactive)] – This outfall receives water from various cooling towers on site. This facility is no longer required to treat the influent because the plant converted from a chromate-based to a phosphate-based corrosion inhibitor system in 1992. Water from this facility is discharged to the Scioto River.

USEC NPDES Outfall 005 (X-611B Lime Sludge Lagoon) – The X-611B Lime Sludge Lagoon is used to settle lime sludge used in a water-softening process. The X-611B also receives rainwater runoff. Water from this facility is generally returned to the X-611 Water Treatment Plant for treatment. Direct discharges from this facility occur only during periods of excessive rainfall. During such rare events, the lagoon discharges to Little Beaver Creek.

USEC NPDES Outfall 009 (X-230L North Holding Pond) – The X-230L North Holding Pond receives non-contact cooling water, steam condensate, and storm runoff. The pond provides an area where materials suspended in the influent can settle and chlorine can dissipate. Water from this holding pond is discharged to an unnamed stream that flows to Little Beaver Creek.

USEC NPDES Outfall 010 (X-230J5 Northwest Holding Pond) – The X-230J5 Northwest Holding Pond receives non-contact cooling water, steam condensate, and storm runoff. The pond provides an area

where materials suspended in the influent can settle and chlorine can dissipate. Water from this holding pond is discharged to the West Ditch, which flows to the Scioto River.

USEC NPDES Outfall 011 (X-230J6 Northeast Holding Pond) – The X-230J6 Northeast Holding Pond receives non-contact cooling water, steam condensate, and storm runoff. The pond provides an area where materials suspended in the influent can settle, chlorine can dissipate, and oil can be diverted and contained. Water from this holding pond is discharged to an unnamed stream that flows to Little Beaver Creek.

USEC NPDES Outfall 602 (X-621 Coal Pile Runoff Treatment Facility) – The X-621 Coal Pile Runoff Treatment Facility treats storm water runoff from the coal pile at the X-600 Steam Plant. The treated water is discharged to the X-230K South Holding Pond (USEC NPDES Outfall 002).

USEC NPDES Outfall 604 (X-700 Biodenitrification Facility) – The X-700 Biodenitrification Facility receives solutions from plant operations that are high in nitrate. At the X-700, these solutions are diluted and treated biologically using bacteria prior to being discharged to the X-6619 Sewage Treatment Plant (USEC NPDES Outfall 003).

USEC NPDES Outfall 605 (X-705 Decontamination Microfiltration System) – The X-705 Decontamination Microfiltration System treats process wastewater using microfiltration and pressure filtration technology. The treated water is discharged to the X-6619 Sewage Treatment Plant (USEC NPDES Outfall 003).

4.4.1.1 Radiological liquid discharges

Both DOE and USEC monitor NPDES outfalls for radiological discharges by collecting water samples and analyzing the samples for radionuclides. Samples are analyzed for gross alpha activity, gross beta activity, technetium, and total uranium.

Discharges of radionuclides in liquids through DOE NPDES outfalls have no significant impact on public health and the environment. Uranium discharges from DOE NPDES outfalls in 1999 totaled 0.59 kg. This value was calculated using monthly monitoring data from the DOE NPDES outfalls. Gross alpha and gross beta measurements at the DOE NPDES outfalls indicated that 0.0079 curie of radioactivity was discharged through these outfalls during 1999.

Data collected by USEC and provided to DOE showed that USEC released 21.14 kilograms of uranium through its NPDES outfalls in 1999. Total radioactivity (based on alpha and beta measurements) released through the USEC NPDES outfalls was 1.08 curies. Analytical results below the detection limit were assigned a value of zero in the calculations to determine the quantities of uranium and radiation discharged through the DOE and USEC NPDES outfalls.

4.4.1.2 Radiological monitoring results for surface water from DOE cylinder storage yards

Ohio EPA requires monthly collection of surface water samples from the X-745C and X-745E Depleted Uranium Hexafluoride Cylinder Storage Yards. All samples collected during 1999 were analyzed for gross alpha activity, gross beta activity, and total uranium. During 1999, gross alpha activity ranged from less than 1 pCi/L to 52 pCi/L; gross beta activity ranged from less than 3 pCi/L to 148 pCi/L; and total uranium ranged from less than 1 to 14.5 Fg/L. Beginning in September 1999, samples were also analyzed for total PCBs, technetium, americium-241, americium-243, neptunium-237, plutonium-238, and plutonium-239. These parameters were not detected at levels greater than the applicable detection limits.

4.4.1.3 Nonradiological liquid discharges

Nonradiological discharges from DOE NPDES outfalls are regulated by the DOE NPDES permit. The permit was issued to DOE/PORTS on September 1, 1995 and modified on December 1, 1996, and May 1, 1997. Sampling of nonradioactive constituents is regulated under the DOE/PORTS NPDES permit, and analyses are performed in accordance with applicable regulations. In 1999, the DOE NPDES compliance rate was 100%. Compliance rates for individual parameters was 100%.

This report does not include results for nonradiological monitoring of USEC NPDES outfalls.

4.4.2 Surface Water Monitoring

In 1999, USEC collected water samples at locations upstream and downstream from the PORTS reservation. These samples were taken from the Scioto River, Little Beaver Creek, Big Beaver Creek, and Big Run Creek (see Fig. 4.4). As background measurements, samples were also collected from local streams approximately 10 miles north, south, east, and west of PORTS. Samples were collected weekly from the Scioto River and monthly from the other streams, with the exception of one of the downstream locations on Little Beaver Creek (RW-8), which was sampled weekly.

Each sample was analyzed for gross alpha activity, gross beta activity, total uranium, and technetium. Each of these measurements, with the exception of technetium, will detect naturally occurring radionuclides in the environment; therefore, gross alpha, gross beta, and uranium measurements from upstream locations are compared to downstream locations to assess whether PORTS activities have affected the river or stream. Natural variation and manmade activities not related to PORTS can also cause sample variation. In 1999, no significant differences were noted in the surface water samples collected at either the upstream or downstream sampling location. For the majority of samples, these constituents were not detected. Technetium was detected in only one sample in 1999 -- the upstream sampling location on the Scioto River (RW-6). Based on the results of this monitoring program, it does not appear that PORTS activities affected local surface waters in 1999.

4.5 SEDIMENT

In 1999, USEC collected sediment samples at the same locations upstream and downstream from the PORTS reservation where surface water samples are collected and at the NPDES outfalls on the west side of the reservation (see Fig. 4.4). Samples were collected in the spring and fall and were analyzed for 21 metals, PCBs, gross alpha activity, gross beta activity, total uranium, and technetium. Metals, uranium, gross alpha activity, and gross beta activity occur naturally in the environment; therefore, these constituents detected in the samples may not result from activities at PORTS. The results of sampling conducted in 1999 appear to indicate that there are no appreciable differences in the levels of these constituents found in the samples taken upstream and downstream from PORTS.

Historically, PORTS sediment sampling has detected low levels of technetium and PCB contamination in the Little Beaver Creek east of PORTS. This contamination was caused by discharges of treated process water before 1988. Although these discharges have stopped, sediment contamination still remains. The level of contamination is decreasing over time, however. In 1999, low concentrations of technetium and PCBs were detected in samples collected from downstream sampling locations on the Little Beaver Creek (RM-7, RM-8, and RM-11). In the fall of 1999, technetium was also detected at one of the west outfalls (RM-10) at a concentration just above the detection limit. PCBs and technetium were not detected at the two outfall sampling locations at any other time in 1999.

Fig. 4.4. USEC surface water and sediment monitoring locations.

Technetium was also detected at downstream sampling locations on Big Beaver Creek and Big Run Creek. PCBs were not detected in samples collected from Big Run Creek and Big Beaver Creek in 1999.

There were no appreciable differences in concentrations of detected constituents in upstream and downstream samples collected from the Scioto River in 1999. PCBs and technetium were not detected in upstream or downstream samples collected from the Scioto River.

4.6 SOIL

USEC collects soil samples in the process area of the PORTS reservation, on unused land on the PORTS reservation, and in off-site locations up to 10 miles from PORTS (see Figs. 4.5 and 4.6). Samples are analyzed for gross alpha activity, gross beta activity, total uranium, and technetium. Analytical results from the external samples (samples not collected in the process area of PORTS) represent natural background radionuclides and deposition of airborne radionuclides from PORTS. Analytical results from samples collected in the process area of PORTS also represent background radionuclides and airborne deposition, but can also include radionuclides deposited from spills or other plant operations.

Both the historical and 1999 sampling programs have identified areas of soil contamination within the process area of PORTS. Analytical results from the external samples collected near PORTS are not appreciably different from results of samples collected 10 miles from PORTS. These results appear to indicate that PORTS activities have not resulted in soil contamination outside the process area of PORTS.

4.7 BIOLOGICAL MONITORING

Biological monitoring at PORTS is used to assess the uptake of radionuclides and other constituents into local biota (deer, fish, vegetation, and crops). DOE collects samples of deer harvested during the hunting season. USEC collects data to assess potential impacts to vegetation, crops, and fish at or near PORTS.

4.7.1 Deer

Sixteen deer were harvested at PORTS during the 1999-2000 hunting season (December 1999 through January 2000). The kidneys and liver were collected from each deer for analysis because these organs concentrate any radiological constituents ingested by the deer. Each kidney and liver sample was analyzed for americium-241, neptunium-237, plutonium-238, plutonium-239/240, technetium-99, total uranium, uranium-233/234, uranium-235, uranium-236, and uranium-238.

Naturally-occurring uranium was detected in most of the samples at concentrations just above detection limits. None of the other radionuclides listed above were present above detection limits.

4.7.2 Fish

USEC collects fish at some of the surface water sampling locations shown in Fig. 4.4 and analyzes the fish for chromium, PCBs, gross alpha activity, gross beta activity, technetium, and total uranium. In 1999, PCBs were detected in 10 of 13 fish sampled. PCBs, a widespread environmental contaminant, are often detected in fish and may or may not be present as a result of PORTS activities. Chromium was detected in one of the fish samples collected in 1999.

Gross alpha activity, gross beta activity, technetium, and total uranium were not detected in any of the fish samples collected in 1999.

4.7.3 Vegetation

To assess the uptake of radionuclides into plant material, USEC collects vegetation samples in the same areas where soil samples are collected (see Figs. 4.5 and 4.6). Vegetation is analyzed for fluoride, technetium, and total uranium. Vegetation collected in 1999 within the process area of PORTS and within PORTS boundaries contained detectable concentrations of fluorides and technetium. No uranium was detected in the vegetation collected within the process area or PORTS boundaries in 1999.

Vegetation samples collected off site in 1999 did not contain technetium above detection limits. One sample contained uranium at the detection limit. Fluorides were present in samples at concentrations that are most likely indicative of background levels.

4.7.4 Crops

In addition to vegetation samples, USEC also collects crop samples both on site and off site to assess the uptake of radionuclides into crops. In 1999, four samples were collected from PORTS (apples and persimmons) and 20 samples were collected from locations near PORTS. Crops collected from locations near PORTS included apples, corn, tomatoes, pumpkins, peppers, and raspberries. Each sample was analyzed for technetium and total uranium. Neither constituent was detected in any of the samples collected in 1999.

Fig. 4.5. On-site monitoring locations for the USEC soil and vegetation monitoring programs.

Fig. 4.6. Off-site monitoring locations for the USEC soil and vegetation monitoring programs.